

PD73Z2xOW / P-736.ZxN2S Plnano® Piezo Scanner Systems



Contents

System Description	3
Possible System Components	3
Available PInano® Piezo Scanner Systems	3
Compatibility	4
Accessories	4
Symbols and Typographic Conventions	5
Other Applicable Documents	5
Intended Use	6
Safety Precautions	6
Electrical Dangers	6
Mechanical Dangers	8
Product Description	9
Product View	9
Scope of Delivery	9
Installation.....	10
Connecting the P-736 to the Protective Earth Conductor	10
Mounting the P-736 onto the M-687	12
Mounting a Sample Holder onto the P-736	14
Connecting the P-736 to the Controller	15
Starting Up and Operating the P-736	15
Discharging the P-736.....	16
Maintenance.....	16
Cleaning the P-736	16
Customer Service	17
Technical Data	17
Dimensions	19
Maximum Ratings.....	23
Ambient Conditions and Classifications	23
Old Equipment Disposal	24

System Description

The P-736 PInano® Z microscope scanners* for well plates are designed for inverse microscopy using microscopes by Nikon and Olympus. Each system consists of a P-736 PInano® Z piezo scanner and an E-709.xRG digital piezo controller.

* See below for the different models. Note that the scanners may be referred to as “P-736”, “stage” or “Z piezo scanner” in this user manual.

Possible System Components

Standard versions of the P-736 PInano® Z piezo scanner:

Product number	Description
P-736.ZCN2	PInano® Z piezo scanner for inverted Nikon microscopes, 220 µm, well plate size aperture, capacitive sensors
P-736.ZRN2	PInano® Z piezo scanner for inverted Nikon microscopes, 220 µm, well plate size aperture, piezoresistive sensors
P-736.ZCO	PInano® Z piezo scanner for inverted Olympus microscopes, 220 µm, well plate size aperture, capacitive sensors
P-736.ZRO	PInano® Z piezo scanner for inverted Olympus microscopes, 220 µm, well plate size aperture, piezoresistive sensors

Standard versions of the E-709.xRG digital piezo controller:

Product number	Name
E-709.CRG	Digital piezo controller, 1 channel, -30 to 130 V, capacitive sensor, bench-top
E-709.PRG	Digital piezo controller, 1 channel, -30 to 130 V, piezoresistive sensor, bench-top

Available PInano® Piezo Scanner Systems

The following PInano® piezo scanner systems are available as combinations of Z piezo scanner and digital piezo controller:

System	Z piezo scanner				Digital piezo controller	
-	P-736.ZCN2	P-736.ZRN2	P-736.ZCO	P-736.ZRO	E-709.CRG	E-709.PRG
P-736.ZCN2S	x	-	-	-	x	-
P-736.ZRN2S	-	x	-	-	-	x
PD73Z2COW	-	-	x	-	x	-
PD73Z2ROW	-	-	-	x	-	x

Compatibility

The P-736 PInano® Z piezo scanners can be mounted onto the M-687 XY microscope stages or a suitable mounting surface.

The table below shows the compatibility (x = compatible):

P-736 model	M-687.UN	M-687.UO
P-736.ZCN2	x	-
P-736.ZRN2	x	-
P-736.ZCO	-	x
P-736.ZRO	-	x

Accessories

Product number	Description	Suitability	
		P-736.ZxN2	P-736.ZxO
P-736.UHN	Universal holder for microscope slides and Petri dishes, for P-736.ZxN2 PInano® Z piezo scanner stage for inverted Nikon microscopes with large aperture for microtiter plates	x	-
P-736.WPN	Microtiter plate holder, for P-736.ZxN2 PInano® Z piezo scanner stage for inverted Nikon microscopes with large aperture for microtiter plates	x	-
P-736.PDN	Petri dish holder, 35 mm dish, for P-736.ZxN2 PInano® Z piezo scanner stage for inverted Nikon microscopes with large aperture for microtiter plates	x	-
P-736.SHN	Microscope slide holder for P-736.ZxN2 PInano® Z piezo scanner stage for inverted Nikon microscopes with large aperture for microtiter plates	x	-
M-687.AP1	Universal holder for microscope slides and Petri dishes for PI stages with 160 mm × 110 mm clear aperture	-	x
P-736.WPO	Microtiter plate holder, for P-736.ZxO PInano® Z piezo scanner stage for inverted Olympus microscopes with large aperture for microtiter plates	-	x
P-736.PDO	Petri dish holder, 35 mm dish, for P-736.ZxO PInano® Z piezo scanner stage for inverted Olympus microscopes with large aperture for microtiter plates	-	x
P-736.SHO	Microscope slide holder for P-736.ZxO PInano® Z piezo scanner stage for inverted Olympus microscopes with large aperture for microtiter plates	-	x

Symbols and Typographic Conventions

The following symbols and typographic conventions are used in this user manual:

CAUTION



Dangerous situation

If not avoided, the dangerous situation will result in minor injury.

- Actions to take to avoid the situation.

NOTICE



Dangerous situation

If not avoided, the dangerous situation will result in damage to the equipment.

- Actions to take to avoid the situation.

INFORMATION

Information for easier handling, tricks, tips, etc.

Symbol/Label	Meaning
1.	Action consisting of several steps whose sequential order must be observed
2.	
➤	Action consisting of one or several steps whose sequential order is irrelevant
▪	List item
p. 5	Cross-reference to page 5
RS-232	Labeling of an operating element on the product (example: socket of the RS-232 interface)
 	Warning signs affixed to the product that refer to detailed information in this manual.

Other Applicable Documents

The devices and software tools which are mentioned in this documentation are described in their own manuals.

Product	Document
E-709 digital piezo controller	PZ222E user manual
M-687.UN XY microscope stage for inverted Nikon microscopes	MP100E user manual
M-687.UO XY microscope stage for inverted Olympus microscopes	MP107E user manual

Intended Use

The P-736.ZxN2 / P-736.ZxO PInano® Z piezo scanners and the E-709.xRG digital piezo controllers are laboratory devices as defined by DIN EN 61010-1. They are intended to be used in interior spaces and in an environment which is free of dirt, oil and lubricants.

Based on their design and realization, the Z piezo scanners are intended to position in Z direction. They are designed to position a sample holder with suitable dimensions that can carry an object slide or a Petri dish.

The Z piezo scanners can carry a maximum load of 0.5 kg. They are intended to be used with M-687.Ux XY microscope stages or with other suitable microscope stages. The Z piezo scanners are to be mounted horizontally.

The intended use of the Z piezo scanners is only possible in combination with the E-709.xRG digital piezo controllers. The E-709.xRG controllers provide the required operating voltages. To ensure proper performance of the servo-control system, the controller is able to read out and process the signals from the capacitive or piezoresistive sensors.

Safety Precautions

Electrical Dangers

CAUTION



Dangerous voltage and residual charge on piezo actuators!

The P-736 is driven by piezo actuators. Temperature changes and compressive stresses can induce charges in piezo actuators. After being disconnected from the electronics, piezo actuators can also stay charged for several hours. Touching or short-circuiting the contacts in the connector of the P-736 can lead to minor injuries. In addition, the piezo actuators can be destroyed by an abrupt contraction.

- Do **not** open the P-736.
- Discharge the piezo actuators before installation:
Connect the piezo actuator to the switched-off PI controller.
- Do **not** pull the connector out of the electronics during operation.



For piezo scanners with Sub-D connector:

Touching the contacts in the connector can lead to an electric shock (max. 130 V DC) and minor injuries.

- Do **not** touch the contacts in the connector.
- Secure the connector of the piezo scanner with screws against being pulled out of the controller.

CAUTION**Risk of electric shock if the protective earth conductor is not connected!**

If a protective earth conductor is not or not properly connected, dangerous touch voltages can occur and there is a risk of electric shock. In the case of malfunction or failure of the system, touching the P-736 can result in minor injuries.

- Connect the P-736 to a protective earth conductor (p. 10) before start-up.
- Do **not** remove the protective earth conductor during operation.
- If the protective earth conductor has to be temporarily removed (e.g., for modifications), reconnect the P-736 to the protective earth conductor before starting it up again.

NOTICE**Destruction of the piezo actuator by electric flashovers!**

The use of the P-736 in environments that increase the electrical conductivity can lead to the destruction of the piezo actuator by electric flashovers. Electric flashovers can be caused by moisture, high humidity, liquids and conductive materials such as metal dust. In addition, electric flashovers can also occur in certain air pressure ranges due to the increased conductivity of the air.

- Avoid operating the P-736 in environments that can increase the electric conductivity.
- Only operate the P-736 within the permissible ambient conditions and classifications (p. 23).

NOTICE**Destruction of the piezo actuator by continuously high voltage!**

The constant application of high voltage to piezo actuators can lead to leakage currents and flashovers that destroy the ceramic.

If the P-736 is not used, but the controller is to remain switched on to ensure temperature stability:

- Set the piezo voltage to 0 V on the controller.

NOTICE**Unsuitable cables!**

Unsuitable cables can damage the electronics.

- Only use cables from PI for connecting the P-736 to the electronics.

INFORMATION

Extended cables can affect the performance of the P-736.

- Do **not** use cable extensions. If you need longer cables, contact our customer service department (p. 17).

Mechanical Dangers**NOTICE****Appropriate torque required!**

The specifications are only achieved if a minimum torque is observed when mounting the stage onto the M-687.Ux (or any other suitable microscope stage). A torque too high can cause damage to the stage.

- When mounting the stage onto the M-687.Ux (or any other suitable microscope stage), observe a torque range between 250 and 270 Ncm for the three included M4 screws.

NOTICE**Unallowable forces on motion platform!**

Exerting a push force >50 N or a pull force >30 N on the motion platform can damage the stage and render the mechanical design inoperable.

- Do **not** exceed a push force of 50 N on the motion platform.
- Do **not** exceed a pull force of 30 N on the motion platform.

NOTICE**Screws that are too long!**

The P-736 can be damaged by screws that are too long.

- Note the depth of the mounting holes in the motion platform (p. 19).
- Only use screws of the correct length for the respective mounting holes.

NOTICE**Lubricants, dirt, condensation!**

Dirt, oil, lubricants and condensation will render the motor/drive inoperable.

- Ensure that the piezo actuators of the P-736 do not come into contact with lubricants.
- Keep the P-736 free from dirt and condensation.

NOTICE**Uncontrolled oscillation!**

Oscillations can cause irreparable damage to the P-736. Oscillations are indicated by a humming and can result from the following causes:

- The load and/or dynamics of operation differ too much from the calibration settings.
- The P-736 is operated near its resonant frequency.
- If you notice oscillations, stop the P-736 immediately.

Product Description

Product View



Figure 1: P-736.ZCO as example

- 1 One of four threaded holes for mounting a sample holder (see "Accessories", p. 4)
- 2 Motion platform
- 3 Cable exit
- 4 One of three countersunk holes for mounting the P-736 onto an M-687.Ux XY stage
- 5 Base body

Scope of Delivery

A PInano® piezo scanner system is delivered with the following components:

Product number	Description
P-736	PInano® Z piezo scanner according to order (p. 3), including screws for mounting the P-736 onto the M-687 XY stage: • For P-736.ZxN2 models: Three M4x10 socket head screws (U00001295) for mounting the stage onto an M-687.UN stage • For P-736.ZxO models: Three M4x14 socket head screws (000052508) for mounting the stage onto an M-687.UO stage

Product number	Description
E-709.xRG	Digital piezo controller according to order (p. 3)
C-501.24050H	Wide-range-input power supply, 24 V / 50 W
3763	Power cord
000036360	USB cable (3 m, USB-A (m)/USB Mini-B (m)) for PC connection
E709B0002	RS-232 adapter HD Sub-D 26 (m) to Sub-D 9 (m) for PC connection via RS-232
C-815.34	Null-modem cable for PC connection via RS-232
E-709.04	Adapter cable for analog I/O (1 m, HD Sub-D 26 / 2 × BNC)
000036450	M4 screw set for protective earth connection
Documentation, consisting of:	
PZ240EK	Short instructions for piezo positioning systems
PZ222E	User manual for E-709 digital piezo controllers
E-709.CD	CD with PC software and documentation of the E-709 digital piezo controller
A000T0032	Technical note on updating the PI Software using the PI Update Finder
A000T0028	Technical note on using the PI Update Finder
-	Packaging materials

Installation

Connecting the P-736 to the Protective Earth Conductor

INFORMATION

In the case of P-736 models with Sub-D connectors, ground loops can occur when the P-736 is grounded via its protective earth connection or the mounting holes as well as by the shield of the connecting cable for the electronics.

- If a ground loop occurs, contact our customer service department (p. 17).

INFORMATION

- Observe the applicable standards for mounting the protective earth conductor.

The P-736 features a protective earth connection which is marked with the symbol for the protective earth conductor .

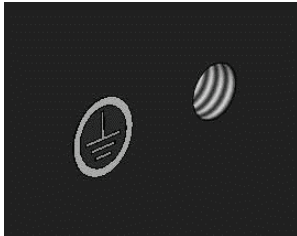


Figure 2: Example of a protective earth connection

Requirements

- ✓ You have read and understood the safety precautions (p. 6).
- ✓ The P-736 is **not** connected to the controller.

Tools and accessories

- Suitable protective earth conductor: Cross-sectional area of the cable $\geq 0.75 \text{ mm}^2$
- M4 protective earth screw set (p. 9) for connecting the protective earth conductor
- Suitable screwdriver

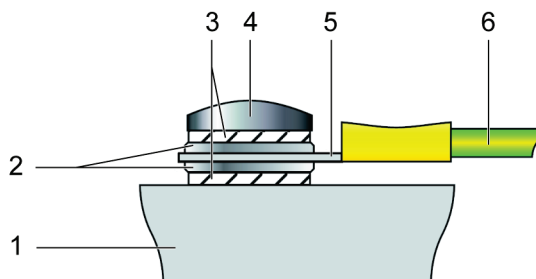


Figure 3: Mounting of the protective earth conductor (profile view)

- 1 Base body of the P-736
- 2 Flat washer
- 3 Safety washer
- 4 Screw
- 5 Cable lug
- 6 Protective earth conductor

Connecting the P-736 to the protective earth conductor

1. If necessary, fasten a suitable cable lug to the protective earth conductor.
2. Use the M4 screw (together with the washers and self-locking washers) to affix the cable lug of the protective earth conductor to the protective earth connection of the P-736 as shown in the profile view.
3. Tighten the M4 screw with a torque of 1.2 Nm to 1.5 Nm.
4. Make sure that the contact resistance at all connection points relevant for mounting the protective earth conductor is $<0.1 \Omega$ at 25 A.

Mounting the P-736 onto the M-687

Mounting the P-736.ZxN2 onto the M-687.UN

INFORMATION

The upper motion platform of the M-687.UN features an adapter plate which has to be removed before mounting a P-736.ZRN2 or P-736.ZCN2 PInano® Z piezo scanner onto the M-687.UN.

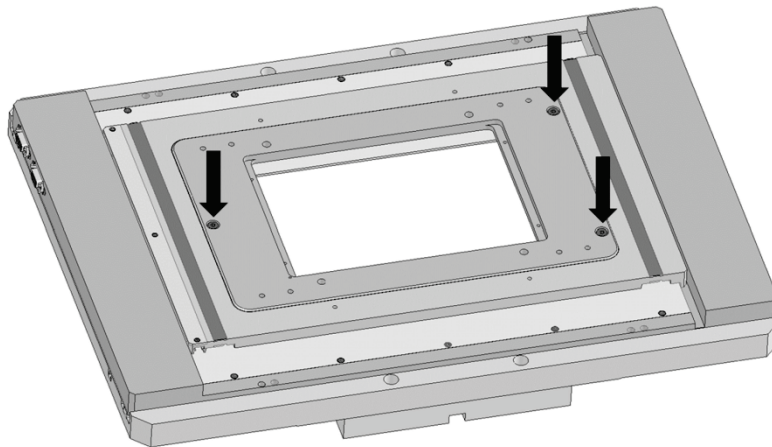


Figure 4: M-687.UN: Fixing screws of the adapter plate

Requirements

- ✓ You have read and understood the safety precautions (p. 6).
- ✓ The P-736.ZxN2 is **not** connected to the controller.

Tools and accessories

- Three M4x10 socket head screws (in scope of delivery, p. 9)
- Suitable screwdriver

Mounting the P-736.ZxN2 onto the M-687.UN

1. Loosen the three M4 fixing screws (see Figure 4 above) of the adapter plate.
2. Remove the screws and the adapter plate.
3. Align the P-736.ZxN2 with the M-687.UN so that the threaded holes in the M-687.UN where the adapter plate was affixed can be used for affixing the P-736.ZxN2.
4. Mount the P-736.ZxN2 onto the M-687.UN using three M4x10 screws, and pay attention to the **torque range of 250 to 270 Ncm**.

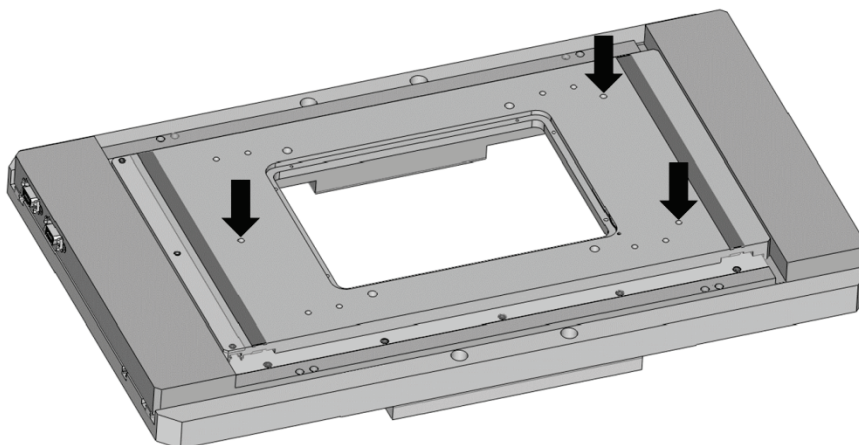
Mounting the P-736.ZxO onto the M-687.UO

Figure 5: M-687.UO: Threaded M4 holes in the upper platform

Requirements

- ✓ You have read and understood the safety precautions (p. 6).
- ✓ The P-736.ZxO is **not** connected to the controller.

Tools and accessories

- Three M4x14 socket head screws (in scope of delivery, p. 9)
- Suitable screwdriver

Mounting the P-736.ZxO onto the M-687.UO

1. Align the P-736.ZxO with the M-687.UO so that the three M4 holes in the upper platform of the M-687.UO (see Figure 5 above) can be used for affixing the P-736.ZxO.
2. Mount the P-736.ZxO to the threaded holes using three M4x14 screws, and pay attention to the **torque range of 250 to 270 Ncm**.

Mounting a Sample Holder onto the P-736

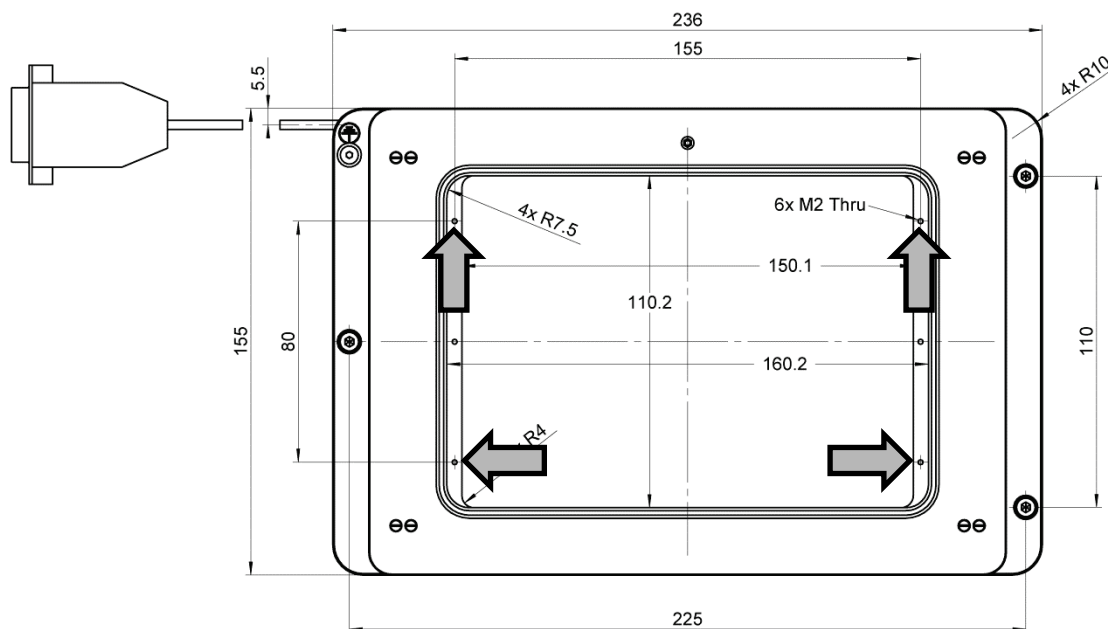


Figure 6: Example view of a P-736.ZCN2. Different sample holders can be fastened to the P-736 using the mounting holes marked by the gray arrows. Note that the holes are M2 for P-736.ZxN2 and M3 for P-736.ZxO.

Requirements

- ✓ You have read and understood the safety precautions (p. 6).
- ✓ The P-736 is **not** connected to the controller.

Tools and accessories

- Suitable sample holder (see “Accessories”, p. 4)
- Suitable screws:
 - P-736.ZxN2: Four M2 screws of suitable length (p. 19)
 - P-736.ZxO: Four M3 screws of suitable length (p. 19)
- Suitable screwdriver

Mounting a sample holder onto the P-736

- Mount the sample holder onto the P-736 using four suitable screws and the four mounting holes shown in Figure 6 above.

Connecting the P-736 to the Controller

Requirements

- ✓ You have read and understood the safety precautions (p. 6).
- ✓ The controller is switched off, i.e., **not** connected to the power source.
- ✓ You have connected the P-736 to the protective earth conductor (p. 10).

Connecting the P-736 to the controller

- Connect the Sub-D connector of the P-736 to the corresponding Sub-D socket of the controller.

Starting Up and Operating the P-736

INFORMATION

Systems are calibrated at the factory to achieve optimum performance. Replacing the system components will cause a loss in performance.

- Note the assignment of the stage axes to the controller channels which is given by the calibration label of the piezo servo controller.
 - If the piezo servo controller or the stage has to be replaced, recalibrate the axis displacement (see controller manual) or contact our customer service department (p. 17).
-

Requirements

- ✓ You have read and understood the safety precautions (p. 6).

Starting up and operating the P-736

- Follow the instructions in the manual of the piezo controller used for start-up and operation of the P-736.

Discharging the P-736

The P-736 must be discharged before demounting. Demounting is necessary e.g., before cleaning or transporting the P-736 as well as for modifications.

Discharging a P-736 that is connected to the controller

In closed-loop operation:

1. Switch off the servo mode on the controller.
2. Set the piezo voltage to 0 V on the controller.

In open-loop operation:

- Set the piezo voltage to 0 V on the controller.

Discharging a P-736 that is not connected to the controller

- Connect the Z piezo scanner to the switched-off PI controller for 10 seconds.

Maintenance

NOTICE



Damage due to improper maintenance!

The P-736 is maintenance-free and precisely aligned.

- Only loosen screws according to the instructions in this manual.
- Do **not** open the P-736.

Cleaning the P-736

Requirements

- ✓ You have discharged (p. 16) the piezo actuators of the P-736.
- ✓ You have disconnected the P-736 from the controller.

Cleaning the P-736

- Clean the surface of the P-736 with a cloth that is lightly dampened with a mild cleanser or disinfectant (e.g., alcohol or isopropyl alcohol).
- Do **not** do any ultrasonic cleaning.

Customer Service

For inquiries and orders, contact your PI sales engineer or send us an email (info@pi.ws).

- If you have questions concerning your system, have the following information ready:
 - Product and serial numbers of all products in the system
 - Firmware version of the controller (if present)
 - Version of the driver or the software (if present)
 - Operating system on the PC (if present)
- If possible: Take photographs or make videos of your system that can be sent to our customer service department if requested.

The latest versions of the user manuals are available for download on our website (www.pi.ws).

Technical Data

	PD73Z2ROW / P-736.ZRN2S	PD73Z2COW / P-736.ZCN2S	Unit	Tolerance
	Lower cost system with P-736.ZRO stage for Olympus microscopes / P-736.ZRN2 stage for Nikon microscopes	Higher precision system with P-736.ZCO stage for Olympus microscopes / P-736.ZCN2 stage for Nikon microscopes		
Active axes	Z	Z		
Motion and positioning				
Integrated sensor	Piezoresistive	Capacitive		
Travel (closed-loop)	220	220	µm	
Resolution (closed-loop)	1	1	nm	typ.
Mechanical properties				
Resonant frequency (loaded, at 100 g)	250	250	Hz	
Load capacity	500	500	g	max.
Drive properties				
Ceramic type	PICMA® P-885	PICMA® P-885		

	PD73Z2ROW / P-736.ZRN2S	PD73Z2COW / P-736.ZCN2S	Unit	Tolerance
Miscellaneous				
Operating temperature range*	15 to 40	15 to 40	°C	
Material	Aluminum	Aluminum		
Mass	850	850	g	±5 %
Cable length	1.7	1.7	m	±10 mm
Piezo controller	E-709 controller included in delivery			
Interface / communication	USB, RS-232, SPI			
I/O connector	HD Sub-D 26-pin 1× analog input 0 to 10 V 1× sensor monitor 0 to 10 V 1× digital input (LVTTL, programmable) 1× analog output 5× digital outputs (LVTTL, 3× predefined, 2× programmable)			
Command set	PI General Command Set (GCS)			
User software	PIMikroMove			
Software drivers	LabVIEW drivers, shared libraries for Windows and Linux. Is supported by MATLAB, MetaMorph, µManager, Andor iQ			
Supported functionality	Wave generator, data recorder, auto zero, trigger I/O			
Controller dimensions	160 mm × 96 mm × 33 mm			

*Specifications assured from 17 °C to 23 °C, performance may be reduced outside this range.

Dimensions

Dimensions of P-736.ZCN2

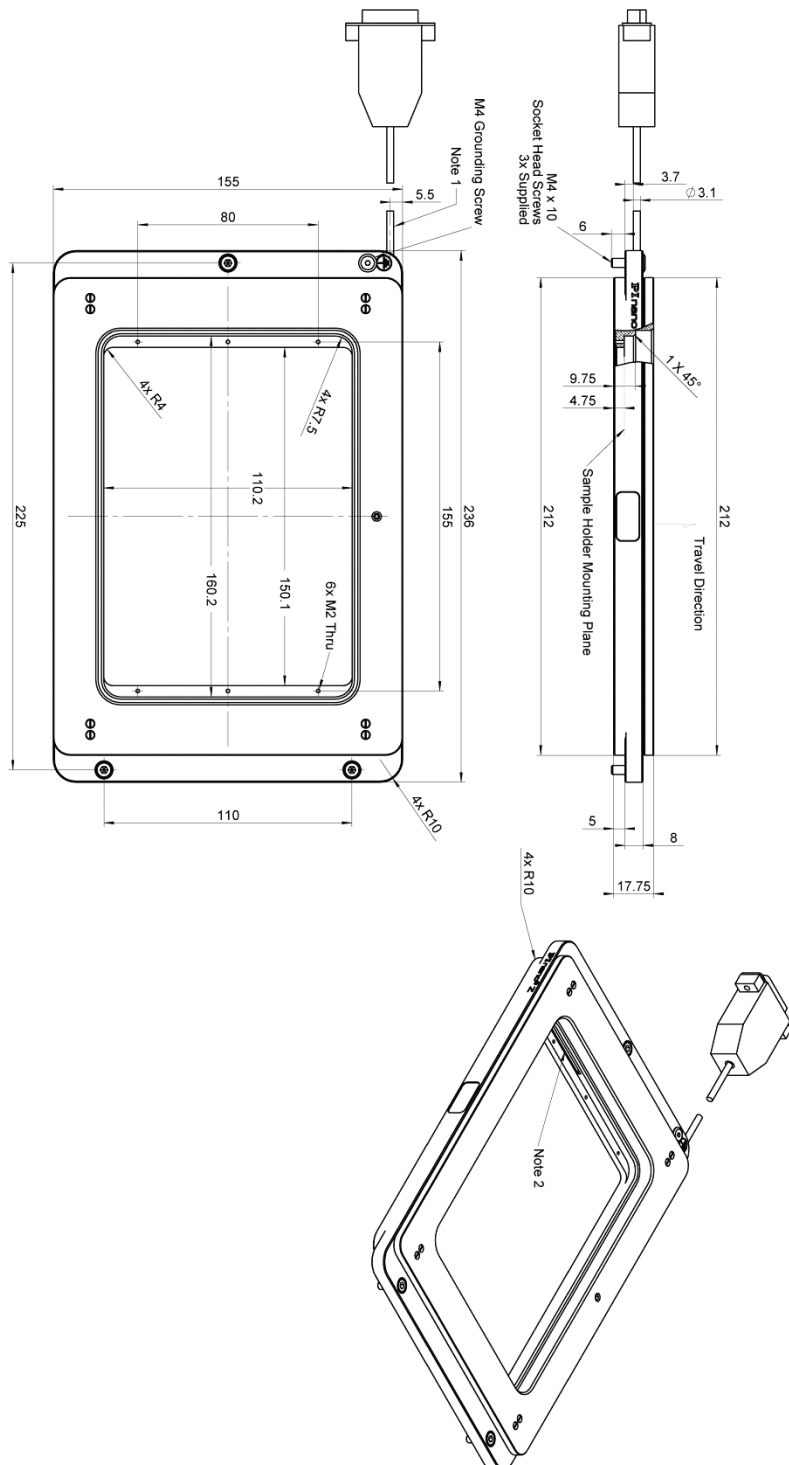


Figure 7: P-736.ZCN2, dimensions in mm

Note 1: Cable length 1.7 m, termination is a Sub-D 7W2

Note 2: Aperture has a spring clip to accept standard 110 x 160 mm K plate sample holders

P736T0001, valid for PD73Z2xOW & P-736.ZxN2S

Technical drawings of the 100 Series Sample Holder, showing front and side views with dimensions and features.

Front View Dimensions:

- Overall Width: 237
- Overall Height: 225
- Inner Width: 160.2
- Inner Height: 110.2
- Top Outer Radius: $4 \times R4$
- Top Inner Radius: $4 \times R7.5$
- Bottom Outer Radius: $4 \times R9.5$
- Bottom Inner Radius: $4 \times R7.5$
- 4x M3 Thru holes (inner)
- 4x M4 Grounding Screws (outer)

Side View Dimensions:

- Overall Height: 17.75
- Top Flange Height: 9.25
- Top Flange Width: 5
- Sample Holder Mounting Plane: 5.75
- Mounting Plane Offset: 1.75
- Bottom Flange Height: 13
- Chamfer: $1 \times 45^\circ$
- Travel Direction: Indicated by an arrow

Notes:

- Note 1: M4 x 14 Socket Head Screws 3x Supplied
- Note 2: (Refer to the 200 Series drawing for details)

Note 2: Aperture has a spring clip to accept standard 110 × 160 mm K plate sample holders

P736T0001, valid for PD73Z2xOW & P-736.ZxN2S

Technical drawing of the Sample Holder Assembly, showing dimensions and labels for various components and features.

Top View Dimensions:

- Overall Width: 155
- Overall Height: 225
- Inner Width: 80
- Inner Height: 110.2
- Distance from top edge to inner frame: 5.5
- Distance from right edge to inner frame: 155
- Distance from bottom edge to inner frame: 160.2
- Distance from left edge to inner frame: 110
- Inner frame corner radius: 4x R4
- Outer frame corner radius: 4x R7.5
- Inner frame corner radius: 4x R10
- Outer frame corner radius: 4x R10
- 6x M2 Thru holes

Side View Dimensions:

- Overall Height: 212
- Distance from top edge to mounting plane: 9.75
- Distance from mounting plane to bottom edge: 4.75
- Distance from bottom edge to base: 5
- Base width: 8
- Base corner radius: 17.75
- Travel Direction

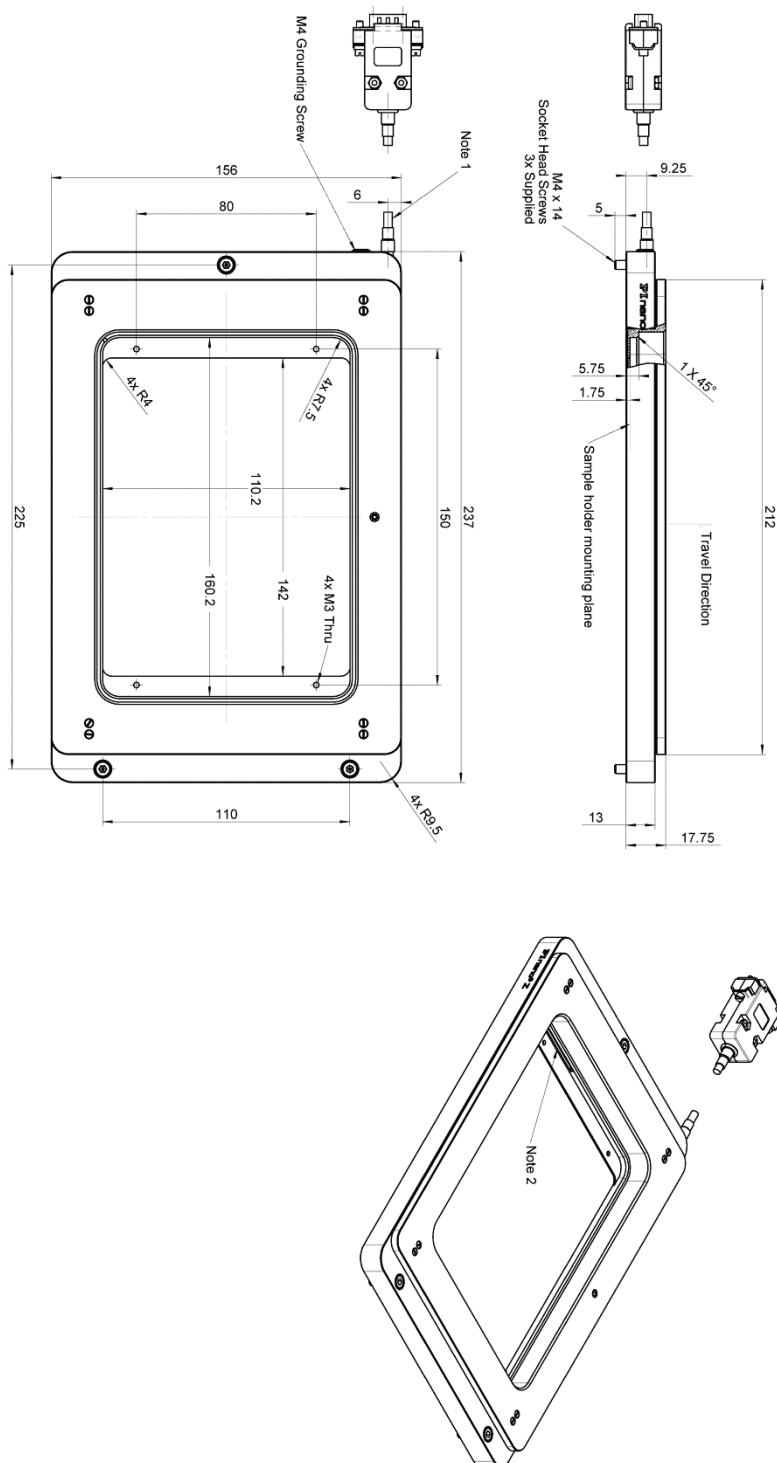
Detail Views:

- Socket Head Screws:** 3x Supplied, M4 x 10
- M4 Grounding Screw:** Note 1
- Note 2:** Points to the inner frame corner radius (4x R10).

Note 1: Cable length 1.7 m, termination is a 9-pin Sub-D
Note 2: Aperture has a spring clip to accept standard 110 × 160 mm K plate sample holders

2017-06-22

P736T0001, valid for PD73Z2xOW & P-736.ZxN2S

Dimensions of P-736.ZRO**Figure 10: P-736.ZRO, dimensions in mm.****Note 1: Cable length 1.7 m, termination is a 9-pin Sub-D****Note 2: Aperture has a spring clip to accept standard 110 × 160 mm K plate sample holders**

Maximum Ratings

The P-736.ZxN2 / P-736.ZxO is designed for the following maximum ratings:

Maximum operating voltage	Maximum operating frequency (unloaded)	Maximum power consumption
		
-30 to 130 V	100 Hz	20 W

Ambient Conditions and Classifications

The following ambient conditions and classifications must be observed for the P-736.ZxN2 / P-736.ZxO :

Area of application	For indoor use only
Maximum altitude	2000 m
Air pressure	1100 hPa to 0.1 hPa
Relative humidity	Highest relative humidity 80 % for temperatures up to 31 °C Decreasing linearly to 50 % relative humidity at 40 °C
Operating temperature*	15° C to 40 °C
Storage temperature	0°C to 70°C
Transport temperature	-25 °C to 85 °C
Overvoltage category	II
Protection class	I
Degree of pollution	1
Degree of protection according to IEC 60529	IP20

*Specifications assured from 17 °C to 23 °C, performance may be reduced outside this range.

Old Equipment Disposal

In accordance with EU law, electrical and electronic equipment may not be disposed of in EU member states via the municipal residual waste.

Dispose of your old equipment according to international, national, and local rules and regulations. In order to fulfil its responsibility as the product manufacturer, Physik Instrumente (PI) GmbH & Co. KG undertakes environmentally correct disposal of all old PI equipment made available on the market after 13 August 2005 without charge.

Any old PI equipment can be sent free of charge to the following address:

Physik Instrumente (PI) GmbH & Co. KG
Auf der Roemerstr. 1
D-76228 Karlsruhe, Germany

